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Is the Emergence of Functional Ability Decline in Early Old Age Related to Change in Speed of Cognitive Processing and Also to Change in Personality?

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Abstract

Objective: To test whether the onset of functional ability decline in early old age is related to change in speed of cognitive processing and personality characteristics. **Method:** Among 500 randomly sampled participants, the 230 cases that did not show impairment in functional ability were selected. Mean age at Time 1 was 62.4 years. For this subsample, the emergence of functional ability decline was tracked across a 12-year observation period. **Results:** The emergence of functional ability decline was related to change in speed of cognitive processing. Decline in functional ability was also related to increased neuroticism and external control, whereas this was not the case regarding extraversion and internal control. **Discussion:** Cognitive processing speed was shown to be a predictor of functional disability decline; in addition, the results provided initial evidence that functional ability decline in the early

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aging phase could be accompanied by changes in personality, particularly neuroticism and external control.

Keywords

early onset of functional ability decline, speed of cognitive processing, personality change

The experience of decline in functional ability continues to be among the most critical experiences of aging. This work treats the relationship of two factors, that is, change in cognitive function and change in personality, with decline in functional ability in old age. We concentrate on *early* old age because this period has been widely ignored in the respective previous research.

Decline of Functional Ability and Change in Cognitive Functioning

Previous research has shown an association between cognitive performance and decrements in functional ability. For one, central executive control (Baddeley, 1996) has been identified as a major factor driving this relationship; executive function includes the coordination of action planning, control of attention, surveillance of working memory, and cognitive flexibility. A substantial body of evidence supports the idea that deficits in executive function are significantly related to decline in functional ability (e.g., Burton, Strauss, Hultsch, & Hunter, 2006; Carlson et al., 1999; Coppin et al., 2006; Royall, Chiodo, & Polk, 2000; Royall, Palmer, Chiodo, & Polk, 2004, 2005). Furthermore, previous longitudinal studies (Royall et al., 2004, 2005) have shown that changes in executive control are important precursors of decline in everyday functioning.

Also, global measures of cognition, such as the mini-mental state examination (MMSE), were initially associated with decline in functional ability in various populations, including Japanese older adults (Dodge et al., 2005), older Mexican Americans (Raji, Ostir, Markides, & Goodwin, 2002), and Canadian elders (Njegovan, Man-Son-Hing, Mitchell, & Molnar, 2001), while their role has been greatly reduced when other cognitive functions such as executive control or speed of processing are considered simultaneously (Burton et al., 2006; Gill, Williams, Richardson, & Tinetti, 1996; Royall et al., 2004). Global variables such as the MMSE may lack sensitivity for the detection of possible associations between cognitive impairment and decline in functional ability, particularly in the early phases of the aging process and long before dementia-related alterations are likely to occur (Burton et al., 2006).

Furthermore, there is a major research trend in the psychology of aging, focusing on the everyday competence of normally aging adults and the explanation of the respective interindividual variations (M. M. Baltes, Maas, Wilms, Borchelt, & Little, 1999). Everyday competence includes basic and instrumental activities of daily living (IADL), but it could also include other domains such as leisure activities or daily problem-solving activities (e.g., Diehl & Willis, 2004). Age-sensitive indicators of cognitive functioning (P. B. Baltes, Lindenberger, & Staudinger, 2006), including executive control, speed of cognitive processing, and episodic memory, are among the major predictors of everyday competence (Burton et al., 2006; Diehl & Willis, 2004; Schaie, 1996). Within this context, Barberger-Gateau, Fabrigoule, Rouch, Letenneur, and Dartigues (1999) have also found speed of cognitive processing to be predictive of performance in four IADL (i.e., telephone use, transportation, medication, finances).

An abundance of research in these areas has been conducted on persons in advanced age. In consequence, whether there is a substantial relationship between decline in speed of cognitive processing and decrements in functional ability among the young-old remains an open question. In particular, we are not aware of any current *longitudinal* study directly targeting this particular research issue. It is important in this context to note that cognitive processing speed starts to decline, on average, in the late 20s, though there is pronounced interindividual variability of decline that occurs into very old age (Schaie, 1996). Speed of cognitive processing is therefore widely considered a key marker of cognitive aging from a life-span perspective (e.g., Park & Reuter-Lorenz, 2009).

Exploring possible associations/relationships between cognitive processing speed and decline in functional disability in early old age may also come with theoretical and practical relevance. Theoretically, if the development of functional ability decline is already significantly related to decrements in cognitive function such as age-related slowing of cognitive information processing in early old age, this would support the view that functional decline may also have an important root in normal cognitive aging processes and is not solely driven by pathological processes such as severe physical impairment or cognitive illness, which typically occur in very old age. Practically, such an insight would provide additional support for early prevention and intervention efforts, for instance, the long-term impact of cognitive training in early old age or even in middle adulthood (e.g., Park & Reuter-Lorenz, 2009).

Decline in Functional Ability and Change in Personality

In contrast to cognitive function, personality-related constructs have been used rarely in previous studies in relation to trajectories of functional ability decline. Previous research indicates that there may be a meaningful relationship between heightened neuroticism and decline in health-related quality of life, which includes aspects of functional ability (Chapman, Duberstein, & Lyness, 2007; Kempen, Jelicic, & Ormel, 1997). The latter fits well with the ongoing general discussion on the role of the five-factor model (FFM; Costa & McCrae, 1984) on a range of health indicators. For instance, Smith and Williams (1992) underscored that most research in this area has concentrated on neuroticism, which has been shown repeatedly to relate to the number of physical illnesses and heightened physical symptoms. Furthermore, recent efforts to evaluate the status of FFM-related research on the aging personality, the issue of stability of the five factors, a classic issue in the area, has been questioned. Arguably, we still do not know enough about interindividual differences in terms of intraindividual stability or change in personality (Mroczek, Spiro, & Griffin, 2006). There is early evidence that change in health and functional competence may be among the candidates eliciting such change, particularly in respect to neuroticism (Mroczek et al., 2006). In contrast, extraversion seems generally to be linked more strongly with the social domain and less with the health and function domain. Support for this assumption comes from studies by Chapman et al. (2007) as well as Kempen et al. (1997), which have not found substantial relationships between extraversion and functional ability–related outcomes.

A major conceptual reason to assume a change-inducing role of functional ability decline in terms of neuroticism could be that the experience of such decline may be perceived particularly in early old age as being *off time* (Neugarten, 1968). As has been found, off-time negative events are linked with higher psychological and physiological stress and heightened negative future expectations as compared to *on-time* negative events (Aspinwall & Taylor, 1997). It is also worth noting in this context that current cohorts of young-old adults probably have the strongest expectation of a disability-free life ever in history (Wahl, Tesch-Römer, & Hoff, 2007). Such consequences may then impact on the component within the FFM that is most susceptible to the experience of stress and a possible threat to the aging self, thus promoting neuroticism.

In addition, control beliefs have also been treated extensively in the geropsychological and developmental psychology literature as being closely related with health-related outcomes (Chipperfield, Perry, & Menec, 1999; Lachman

& Firth, 2004). However, the course of control beliefs as people age may also be regarded as a major outcome of aging in itself. In the Berlin Aging Study focusing on advanced old age, it has been found that internal control beliefs remain constant until very old age, whereas external control beliefs are at the same time increasing substantially (Smith & Baltes, 1999). Referring again to the argument raised by Mroczek et al. (2006) that our evidence regarding the driving forces of intraindividual stability and change of the aging personality is limited, one may argue that the experience of functional decline may also be a good candidate to be considered, when it comes to change in control beliefs as people age. In particular, given the relatively high age sensitivity of external control beliefs, it could well be that the experience of functional decline further enhances such externality. A major reason for this expectation is that functional ability is among the primary indicators of subjectively perceived aging processes and the awareness of age-related change (Diehl & Wahl, 2010). Hence, decline in functional ability may be a strong signal for the individual, particularly for the individual in early old age, that aging and concomitant negative biology processes are now taking over as unavoidable external forces. Some support for this assumption comes from the study of Braungart Fauth, Zarit, Malmberg, and Johansson (2007), in which lowered mastery, a concept with similarity to control beliefs, was related to lowered functional ability over a 4-year follow-up observation period.

Study Goals and Hypotheses

First, we hypothesized that speed of information processing, which can be assumed to substantially decrease as people operate in their early old age, is substantially linked with emerging decline of functional ability in this age period. This hypothesis is to some extent a replication of previous research; however, it extends earlier work in terms of our focus on early old age as well as the availability of a long observation interval inherent in our data (i.e., 12 years; see Method section).

Second, we considered the role of neuroticism and hypothesized that the emergence of functional decline in early old age may be significantly linked across a 12-year observation period with an increase in neuroticism. To make an attempt to test for the specific role of neuroticism in this context, we also included extraversion as a contrast variable.

Third, we also considered the role of control beliefs as an additional personality aspect potentially relevant for functional ability trajectories. We hypothesized that decline of functional ability across the 12-year observation period may be particularly related to change (increase) in external control beliefs but not so much with change (decrease) in internal control beliefs.

Method

Study Design and Sample

The data of this study have been generated within the Interdisciplinary Longitudinal Study of Adult Development (ILSE). ILSE followed two cohorts of community-dwelling aging individuals, that is, those born in 1930/1932 and 1950/1952, across an observation period of 12 years, with measurement waves conducted thus far in 1993/1996, 1997/2000, and 2005/2007. For the current study, only persons from the 1930/1932 cohort were included and only the assessment waves of 1993/1996 (labeled as Time 1 [T1] in this aticle) and 2005/2007 (Time 3 [T3]) were used. The reason for this strategy was that a detailed state-of-the-art assessment of functional ability has only been established in ILSE in the measurement wave 2005/2007 because a low level of variability was expected at T1 and Time 2 (T2), given that participants were in their early to late 60s. There was, however, a detailed clinical-geriatric evaluation done by the project geriatricians and conducted at T1, which allows for the identification of individuals without any functional impairment, even if they were very minor. These persons were followed until T3 12 years later, at which time the functional ability measure was applied. Given this research design, decline of functional ability as measured at T3 with a respective assessment device (see below) could be seen as an indicator of functional ability decline over the 12-year observation period.

At T1, 500 individuals born between 1930 and 1932 were enrolled in the ILSE in two regions in Germany (one in Heidelberg-Mannheim-Ludwigshafen in the west and the other in Leipzig in the east) based on random sampling from city registers with stratification according to gender, which was needed to keep enough men in the envisaged long-term assessment process of the study (52% of men at T1 in final sample; mean sample age at T1 = 62.4, *SD* = 2.4). Level of education in the sample varied between 11.5 years (women in Heidelberg region) and 14.3 years (men in Leipzig region). Men in both regions were mostly married with percentages of 82.3% (Heidelberg region) and 87.7% (Leipzig region), whereas relative frequencies of widowed women reached 20.8% (Heidelberg region) and 14.2% (Leipzig region). Not a single sign of decline in functional ability (difficulty or help needs) was found in 363 out of the 500 participants at T1. Comparing individuals without any functional ability deficits with the remaining group at T1 revealed differences in regard to number of diagnoses, $t(478) = -4.56, p < .001$ (significantly lower in those without any deficits), whereas no differences appeared with respect to gender, $\chi^2(1) = 2.51$, $p = .11$; education, $t(465) = 1.14, p = .26$; and a global health rating, $t(466) = -1.10, p = .27$ (see below for more information on these measures).

A total of 230 cases out of the 363 without loss of functional ability at T1 survived to T3, but there appeared 17 missing values cases at T3, leaving us with a sample of 213 cases for data analysis across the 12-year observation period. These remaining 213 cases showed a lower number of diagnoses ($p = .006$), a lower global health rating ($p < .0001$) as well as higher education ($p = .017$). That is, we use a sample in this study that has been positively biased.

Measures

Functional ability measurement. Our questionnaire contained 24 items spanning the classic content of activities of daily living and IADL and has found earlier use in a large German survey study on care needs in the older German population (Schneekloth & Potthoff, 1993) as well as in our own previous research (e.g., Wahl, Schilling, Oswald, & Heyl, 1999). Items were similar to classic devices such as the procedure suggested by Lawton and Brody (1969). Each item was rated according to the respondent's ability to conduct the task "with no help or difficulty" (0), "only with difficulty, but without help" (1), and "only with help" (2). That is, the theoretical range of this measure varied between 0 and 48. The functional ability questionnaire was applied only at T3. Cronbach's alpha (total score) reached .92.

Cognitive functioning: Speed of cognitive processing. Speed of cognitive processing was assessed by the Digit Symbol Substitution Test (Wechsler, 1981) in its German adapted version as part of the Nuremberg Ageing Inventory (Oswald & Fleischmann, 1993). The task requires the detection of similarities and differences between given digits and symbols as quickly as possible within a time frame of 90 s. The total score of valid answers varies between 0 and 67.

Personality: Neuroticism and extraversion. Neuroticism and extraversion were assessed by the NEO Five-Factor Inventory in the German version and was provided by Borkenau and Ostendorf (1993). Each dimension is based on the assessment of 12 items to be answered using a Likert-type scale with a range from 1 (*completely disagree*) to 5 (*completely agree*). Cronbach's alpha reached in our study .82 and .72 at T1, respectively.

Personality: Control beliefs. Control beliefs were assessed by a scale used in the Berlin Aging Study (Smith & Baltes, 1999). The scale distinguished between internal control beliefs (sample item: "When I am getting the things I desire, it is because I have been working hard for them.") and two dimensions of external control beliefs, that is, powerful others (PO; "In general, it is up to other people to make sure that things do not go wrong in my life.") and chance ("In my life, the most part of positive things are caused by incidental events."). The internal control is based on six items, whereas the external control dimensions are measured using four items for each dimension, that is, PO and chance, respectively. Again, a Likert-type scale ranging from 1 (*completely disagree*) to 5 (*completely agree*) was used as an answering format. Cronbach alpha of internal control reached .71, whereas external control (chance) revealed an alpha that was too low (<.65) and was therefore dropped. External control (PO) showed a Cronbach's alpha of .81.

Consideration of confounding variables. First, we considered "gender," based on evidence from the epidemiologic literature suggesting the existence of gender differences in functional ability levels in old age (e.g., Wolinsky, Stump, Callahan, & Johnson, 1996). Second, based on previous research (Atkinson et al., 2007), we used a "global health rating" based on a health evaluation made by a study geriatrician, which included a general medical examination, clinical status assessment, functional status assessment, and laboratory parameters (ranging from 1 = *very good health* to 6 = *very bad health*). Third, the "number of diagnoses" (morbidity) was calculated following a procedure suggested by Parmelee et al. (Parmelee, Thuras, Katz, & Lawton, 1995). This measure served as a proxy indication for assessing physical comorbidity and was therefore an additional variable related to the overall health status of the study participants.

Procedure

The measures used in the present study were part of a broad-scaled assessment program, which predominantly (94%) took place in our research center (psychosocial measurement program) as well as in a clinical setting (physical and psychiatric examination). The full study program was approved by the Ethical Committee of the Faculty of Medicine of Heidelberg University in January 2005.

Statistical Analysis Design

To explore the relationship between change in functional ability and change in speed of cognitive processing or change in personality from T1 to T3, we used a latent difference score modeling approach (LDSM; McArdle & Hamagami, 2001). Note that because only people with no functional limitations at T1 were included in the data analysis, this measure is a direct indicator of functional ability change between T1 and T3. The mean score of predictors targeting speed of cognitive processing and personality at T1 was used as an indicator of T1 state, whereas latent change scores variables were estimated for T3. The latent change scores were estimates of the true change of the variables and consisted of the state of the former measurement occasion and a change component. Models were run separately for each of the predictors to avoid inflation in parameters estimates. We applied the full information maximum likelihood (FIML) procedure available in the statistical package of AMOS (Arbuckle, 1996; Arbuckle & Wothke, 1999). FIML allows the entire observed data matrix to be used to estimate parameters with missing data and provides unbiased parameter estimates without losing power from sample shrinkage that occurs with traditional listwise or pairwise deletion of missing data.

We tested two series of models. In Series 1, we used only the T1 status of our three confounding variables. In Series 2, we tested for a more dynamic picture; that is, we also included the T1-T3 *change* in global health as measured by the global health rating. The idea behind this second series was that change in global health across the observation period may reveal itself to be an important predictor of loss of functional ability at T3, independent of health status at T1. In terms of statistical indicators to evaluate the model fit and the importance of hypothesized relationships, we rely on the root mean square error of approximation (RMSEA), which should ideally be lower than .05 (Hu & Bentler, 1999). In addition, PCLOSE is a test where the difference between the observed fit value and the desired value of less than .05 is significant. At T1, the standardized estimation of T1 state indicates the relationship between the T1 status of the respective variables and the T3 outcome in terms of functional ability, which is tested for significance (difference from zero). Regarding T1-T3 change, the standardized estimate for the latent difference score is given and again tested for significance (difference from zero). In addition, the standardized estimations of the three confounding variables at T1 and respective significance tests will be reported. It is important not only that the model fit is acceptable but also that the estimates of the latent difference scores are statistically different from zero while pointing in the hypothesized direction.

Results

Descriptive Findings

Overall, 61 (26.5%) out of the 230 participants who did not show any signs of loss of functional ability at T1 and who were reassessed at T3 revealed functional decline 12 years later in terms of showing at least one item rated as "only with difficulty, but without help" or "only with help." The mean functional ability score of the total sample at T3 reached 1.13 (SD = 3.22), that is, about one difficulty in any of the 24 functional items was reported on average.

Table 1. Means and Standard Deviations of Target Variables Depending on Functional Ability Status at T3

Target variable (theoretical range)	No functional ability decline at T3 (n = 152)[a] M (SD)	Functional ability decline at T3[b] (n = 61) M (SD)	Statistical test
Digit Symbol Substitution Test T1 (0-67)[c]	44.34 (10.08)	44.38 (10.17)	$t(211) = -0.02, p = .98$
Digit Symbol Substitution Test T3	40.39 (9.89)	36.72 (10.70)	$t(209) = 2.38, p = .02$
Neuroticism T1 (1-5)	1.48 (0.59)	1.48 (0.57)	$t(204) = -0.01, p = .99$
Neuroticism T3	1.33 (0.55)	1.60 (0.60)	$t(211) = -3.01, p = .00$
Extraversion T1 (1-5)	2.25 (0.51)	2.17 (0.41)	$t(204) = 1.09, p = .28$
Extraversion T3	2.21 (0.52)	2.07 (0.43)	$t(211) = 1.84, p = .07$
Internal control T1 (1-5)	3.59 (0.54)	3.62 (0.51)	$t(204) = -0.37, p = .71$
Internal control T3	3.52 (0.55)	3.51 (0.56)	$t(210) = 0.09, p = .93$
External control (PO) T1 (1-5)	1.71 (0.52)	1.74 (0.59)	$t(204) = -0.41, p = .68$
External control (PO) T3	1.74 (0.62)	2.07 (0.76)	$t(210) = -3.28, p = .00$

T1 = Time 1; T3 = Time 3; PO = powerful others.
a. 17 cases revealed missing data.
b. Decline in functional ability was defined as having answered at least one activity of daily living of the functional ability questionnaire as "only possible," "only with difficulty, but without help," or "only with help."
c. Higher scores indicate better cognitive performance and higher ranking in the respective personality variable.

In terms of data relationships, it is worth mentioning that there were no meaningful connections between speed of cognitive processing as well as our personality-related variables at T1 and functional ability at T3 (all correlations < .12 and n.s.). To test for *change* of our predicting variables across the two measurement waves and functional ability at T3 on the descriptive level, Table 1 shows all means and SD's for our cognitive and personality-related variables across the two measurement points, depending on whether study participants revealed functional ability decline at T3 or not.

As can be seen in Table 1, the starting values of our key variables were all very similar at T1 between the groups, that is, no statistically significant

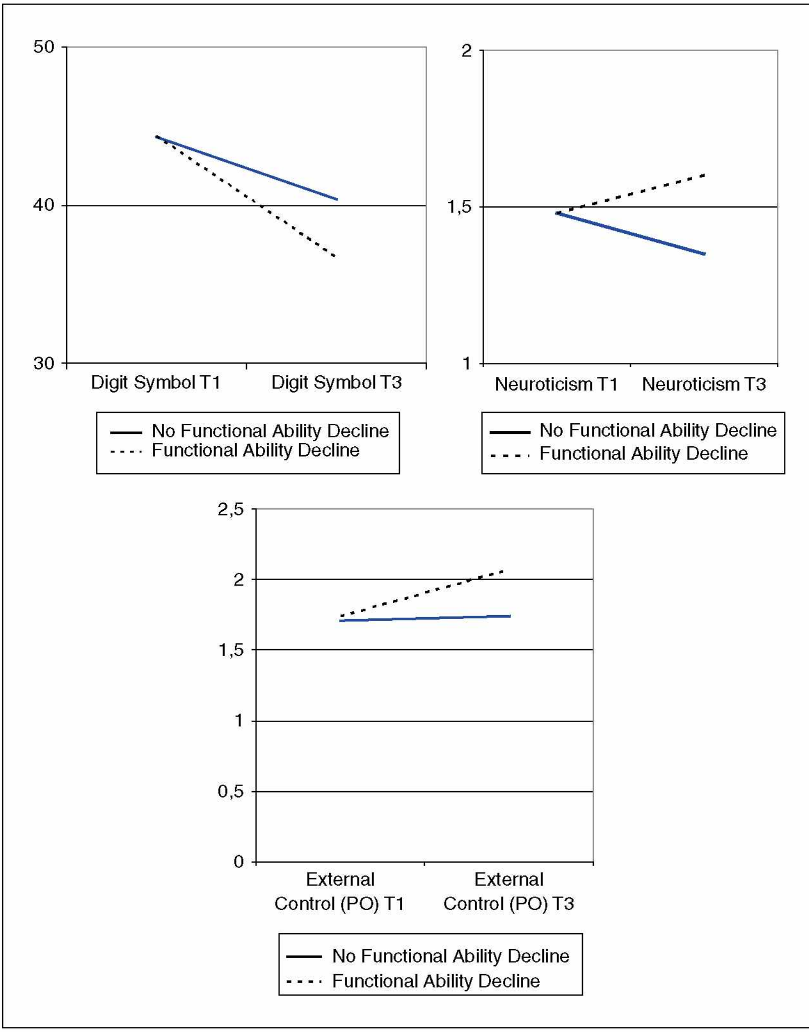

Figure 1 Relationship between functional ability loss and speed of cognitive processing (Digit Symbol Substitution Test), neuroticism, and external control (PO) over time (12-year observation period)
PO = powerful others.

differences were observed. Regarding speed of cognitive processing, though decline in this mechanic intelligence indicator had to be expected in general due to the age-sensitive character of this measure, the decline was clearly steeper in those revealing loss of functional ability at T3 ($p = .02$). In respect to personality, the results showed an increase in neuroticism among the group with functional decline, which was not observed in the unimpaired, where a slight declining trend was found ($p = .00$). No major difference in mean score change was observed in respect to extraversion and the difference at T3 was only marginally significant ($p = .07$). A similar pattern was observed regarding internal control ($p = .93$). In contrast, a considerable increase in external control was only observed in the group with loss of functional ability ($p = .00$). Figure 1 graphically depicts the findings with respect to the hypothetically expected trajectories in terms of speed of cognitive processing, neuroticism, and external control.

Empirical Test of Hypotheses

Table 2 depicts the findings of Series 1 of the LDSM. As depicted, regarding speed of cognitive processing, the model fit was good. Also, the magnitude of the standardized estimate of the latent difference score was significantly different from zero. This supports our hypotheses regarding the expected relationship between speed of cognitive processing and the emergence of functional ability decline over the 12-year period. Also, both neuroticism and extraversion revealed a good model fit, but only the standardized estimate of the latent difference score of neuroticism was significantly different from zero; that is, an increase in neuroticism came along with decline in functional ability. This was not, however, the case regarding extraversion. In terms of control beliefs, the model fit was again good, whereas the standardized estimates of the latent difference scores were significant only with respect to external control (PO). That is, while T1-T3 change in internal control was not related to decline in functional ability at T3, T1-T3 change in external control was related to such decline. As can also be seen in respect to confounding variables, the global health rating played a consistent role across all model tests in the expected direction (lower ratings were associated with lowered functional ability), whereas the number of diagnoses and gender did not.

Table 3 depicts the results of our LDSM Series 2 and includes the role of T1-T3 change in global health rating. As shown, the major findings of Series 1 are preserved with one exception. The model fit in the case of speed of cognitive processing is now at the threshold of acceptance, which indicates that controlling for T1-T3 health change has an impact here. As can also be seen, the global health rating showed a relationship with functional ability not only at its status level at T1 but also consistently in its T1-T3 change dynamics. Controlling for this change component also seemed to strengthen

Table 2. Findings of Latent Difference Score Modeling (Series 1)

Predicting variable	RMSEA	PCLOSE	T1	*p*	T1-T3	*p*	Global health rating	*p*	ND	*p*	Gender	*p*
DST	.075	.143	.036	.603	–.640	.000	.132	.064	.044	.530	.104	.113
N	.047	.466	.077	.306	.231	.001	.177	.013	.029	.685	.101	.136
E	.000	.900	–.068	.340	–.083	.246	–.174	.015	–.045	.527	.103	.121
INTCO	.060	.299	–.068	.388	.037	.638	.185	.010	.059	.410	.092	.173
EXCOPO	.000	.980	.118	.103	.255	.000	.180	.010	.050	.474	.112	.087

RMSEA = root mean square error of approximation; T1 = Time 1; T3 = Time 3; DST = Digit Symbol Substitution Test; N = neuroticism; E = extraversion; INTCO = internal control; EXCOPO = external control (powerful others); ND = number of diagnoses. See text for further explanation of statistical parameters.

Table 3. Findings of Latent Difference Score Modeling (Series 2)

Predicting variable	RMSEA	*p*	T1	*p*	T1-T3	*p*	Global health rating T1	*p*	Global health rating T1-T3	*p*	ND	*p*	Gender	*p*
DST	.095	.008	.023	.729	.599	.000	.401	.000	.397	.000	.006	.929	.123	.049
N	.067	.170	.089	.221	.183	.008	.416	.000	.371	.000	−.010	.879	.117	.071
E	.055	.367	−.074	.274	−.034	.608	.443	.000	.416	.000	−.005	.937	.127	.044
INTCO	.058	.316	−.062	.411	.030	.681	.449	.000	.409	.000	.011	.873	.119	.062
EXCOPO	.032	.733	.155	.024	.234	.000	.444	.000	.411	.000	.001	.984	.136	.027

RMSEA = root mean square error of approximation; T1 = Time 1; T3 = Time 3; DST = Digit Symbol Substitution Test; N = neuroticism; E = extraversion; INTCO = internal control; EXCOPO = external control (powerful others); ND = number of diagnoses. See text for further explanation of statistical parameters.

the role of gender in that women now showed a higher probability to experience decline in functional ability over the 12-year observation period.

Discussion

That cognitive functioning is significantly related to the emergence of decline in functional ability has been an important finding in previous aging research. At the same time, the role of personality variables such as neuroticism, extraversion, and control beliefs, which have been shown to have strong relationships with well-being and health outcomes among the general population as well as among older persons, has rarely been explored in research targeting functional ability decline. Our study aimed to add to the previous literature, from the perspective of early old age.

Speed of cognitive processing showed a strong relationship with decline in functional ability across 12 years in our young-old sample. This finding is consistent with previous social and behavioral gerontology research on everyday competence (e.g., Diehl & Willis, 2004) as well as geriatric research targeting the relationship between cognitive function and functional ability (Burton et al., 2006; Carlson et al., 1999; Coppin et al., 2006; Dodge et al., 2005; Gill et al., 1996; Njegovan et al., 2001; Raji et al., 2002; Royall et al., 2000, 2004, 2005). Our findings also support the notion that even minor functional decline is related to cognitive decrements among persons 62 to 74 years old. Furthermore, our results add to an understanding of risk trajectories emerging already in early old age in terms of a beginning loss of functional independence and then continue and expand as we get older. Although we might not be able to completely ascertain causality because no functional ability measurements comparable to T3 were available at T1 (and T2), previous research in this area suggests that declining cognitive function drives the emergence of functional ability decrements (e.g., Coppin et al., 2006; Diehl & Willis, 2004). Our results further suggests that early decline in the mechanics of intelligence in general, and in speed of cognitive processing in particular, could be considered important risk factors for the development of functional ability decline among the young-old. Consequently, our findings provide additional support for the development of early cognitive training programs as an important health prevention and public health tool that could play a major role in the constant effort to reduce the disability burden of our aging societies (Willis et al., 2006).

In terms of personality variables, our findings confirm that change (increase) in neuroticism, but not change in extraversion, is substantially linked with the occurrence of decline in functional ability. These results are consistent with previous studies highlighting the critical role that neuroticism plays in the overall health of the general population as well as its role as an important health risk factor among older adults (Chapman et al., 2007; Costa & McCrae, 1984; Kempen et al., 1997; Lachman & Firth, 2004; Rovner & Casten, 2001; Wrosch, Schulz, & Heckhausen, 2002). Our findings suggest that neuroticism would be better seen as a *consequence* rather than an *antecedent* condition of loss of functional ability in our young-old sample because of two primary reasons: First, as decade-long research has shown, neuroticism tends to remain stable over the adult life phase and can even decrease as people age (Costa & McCrae, 1984; Staudinger & Kessler, 2009). That is, the assumption that an age-associated increase in neuroticism is a driving force for the onset of functional ability decline does not have a convincing empirical platform. Second, in a more differential view, there is increasing evidence that major life events such as illness and functional decline experiences may trigger personality change over the life course (Mroczek et al., 2006). More specifically, it could well be that individuals who show signs of functional ability decline in their early old age, that is, in an age period that is *off time* (Neugarten, 1968) for such experiences, may react with heightened neuroticism. The reason may be that in early old age, even minor functional losses may be sharply identified as a threat, trigger social comparison processes, and lead to negative arousal and feelings of psychological distress. As a consequence, neuroticism defined as sensitivity for threat, stress, and a tendency toward negative self-evaluations may increase. Note also that both the T1 level of neuroticism as well as extraversion was not linked with decline in functional ability at T3.

Furthermore, our findings are able to qualify the role of *change* in control beliefs regarding functional ability trajectories. Whereas change in internal control was not found to play a role, a consistent relationship was observed with respect to change in external control (PO). Again, no relationship appeared regarding the T1 level of both internal and external control and decline in functional ability at T3. We again tend to interpret the increase in external control (PO) as a consequence, not as a precursor, of the functional ability loss trajectory. Increase in external control but not in internal control has been found to be normative for old and very old age (Smith & Baltes, 1999). It could well be that the early onset of decline in functional abilities further adds to an increase in external control beliefs. Furthermore, it seems more plausible that feeling more dependent on others as well as increasingly perceiving oneself as a victim of uncontrollable biological processes attributed to aging may be a consequence rather than a cause of onset of functional decline in early old age. Unfortunately, our second measure of external control (chance) was not psychometrically strong enough to rigorously test for its relationships with functional ability decline.

It is important to note that our findings mostly preserved their statistical significance, while controlling for a number of confounding variables, that is, a general health rating, comorbidity, and gender. However, the global health rating (Series 1 of model tests) as well as *change* in the global health rating (Series 2 of model tests) consistently revealed to be a major confounding variable. Substantial relationships between change in the global health rating and change in speed of cognitive processing were also indirectly confirmed; that is, the model fit in terms of speed of cognitive processing was affected when change in the T1-T3 global health rating was simultaneously evaluated. These findings suggest the existence of complex interactions between ongoing disease processes and cognitive function, as has been reported in the previous research (e.g., Marcoen, Coleman, & O'Hanlon, 2007).

Our study has a number of limitations. First, a detailed functional-ability assessment available at each measurement occasion of ILSE would have allowed for more rigorous causal analyses such as cross-lagged panel analyses, which might have allowed for more straightforward causal interpretations. Instead, we used a design in which we targeted only those participants who were free of any functional ability decline at T1, which lead to a positively selected subsample. Second, we did not include our cognitive indicator and the personality variables into *one* model because doing so would have produced inflation in parameters in relation to the available sample size. This means that possible interactions between cognitive function and personality in the disablement process have not been directly tested, which may have produced a simplified picture of relationship dynamics. Third, we did not use any additional differentiation within functional-ability levels such as the performance of basic activities and IADL (Lawton & Brody, 1969), which allowed us to maintain transparency in our analyses, although we can reasonably assume that cognitive function, in particular, might operate differently regarding this classic distinction in functioning, that is, a stronger role of cognitive function in the more complex IADL (e.g., Carlson et al., 1999).

Though these are important limitations, we believe that the consistency of our findings with our hypothetical expectations remains remarkable. Our findings can be used to drive forthcoming research, including longitudinal assessments of a variety of cognitive and personality variables as well as objective and self-report measurements of functional ability among older adults.

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